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CE 1639

USER'S MANUAL

VIDEO OCULOGRAPHY

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INTRODUCTION

This document describes the use of the Video-oculography test application available on the Vision Monitor system.

WARNING

Before reading this document, you should be familiarized with the general information related to the hardware and software of the Vision Monitor.

This information is available in the following documents:

DOCUMENT	CONTENT
AA1_US	Vision Monitor – Installation and instructions for use of the equipment
AA2_US	Vision Monitor – Introduction and general operation of the software

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EXAMINATION BASICS

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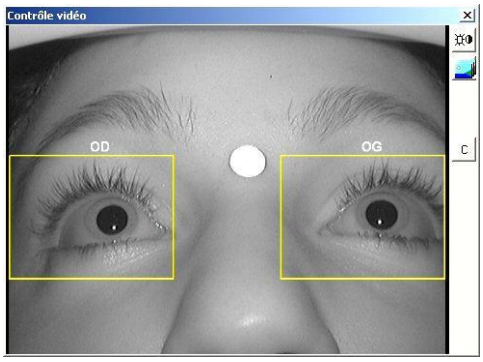
MEASUREMENT OF EYE AND HEAD MOVEMENTS

The measurement of eye and head movements is obtained from video images recorded with a near-infrared camera.
A reflective dot is positioned just above the nasal bridge and is used to determine the position of the head.
The gaze orientation is measured from the positions of the pupils relative to this reflective dot. The advantages of this technique are its independence from head movements and its relative robustness when recording from patients with ocular problems.



STUDY OF OCULAR MOTRICITY

Strabismus evaluation

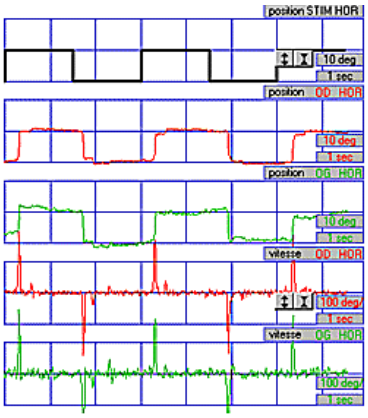
- Fixations.
- Saccades.
- Pursuits.

Neurological evaluation

- Saccades including step, overlap, gap and antisaccades tests
- Pursuits.
- Nystagmus.

Selective collecting and display (user's choice) of 10 simultaneous channels:

- 2 channels for the stimulus horizontal and vertical component.
- 4 position channels.
- 4 velocity channels.



The program ensures the calibration and quantitative analysis of the different types of responses:

- For saccades: velocities and latencies.
- For pursuits: velocity gain
- For nystagmus: amplitude and frequency.

	OD HOR	OG HOR
Vit. max.(d/s) :	-195	-228
Vit. moy.(d/s) :	-14	-14
Latence(msec) :	48	25
Asymétrie(%) :	95	118
Nombre :	3	3

Example of the analysis of saccades

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WHICH EXAM TO CHOOSE

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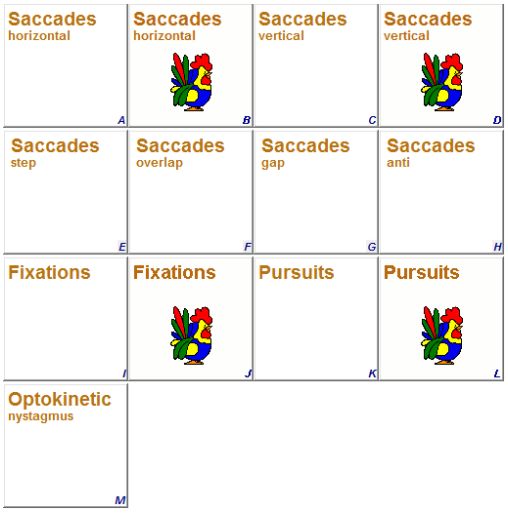
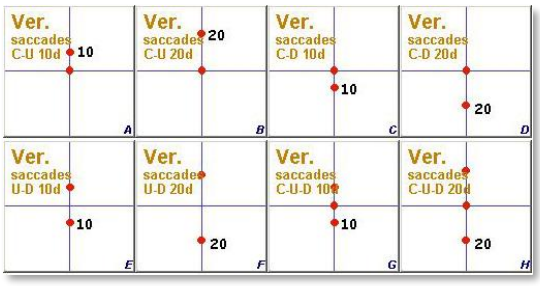
The main menu gives direct access to the different tests available:



HORIZONTAL SACCADES

These tests are designed for the evaluation of abnormal saccadic movements along the horizontal direction. They allow the evaluation of paresis, hypometria, hypermetria and velocity reduction.

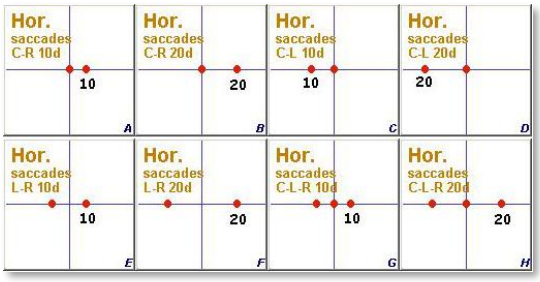
The stimulation makes regular movements from the center (“C”) to the right (“R”) and to the left (“L”).



VERTICAL SACCADES

These tests are designed for the evaluation of abnormal saccadic movements along the horizontal direction. They allow the evaluation of paresis, hypometria, hypermetria and velocity reduction.

The stimulation makes regular movements from the center (“C”) to the up position (“U”) and to the down position (“D”).



STEP, GAP, OVERLAP SACCADES AND ANTISACCADES

These tests are designed for the evaluation of the latency of saccades. The gap paradigm favors reflex saccades whereas the overlap and anti-saccade paradigms favor the voluntary saccades.

The stimulus makes pseudo random movements from the center to either the right or the left.

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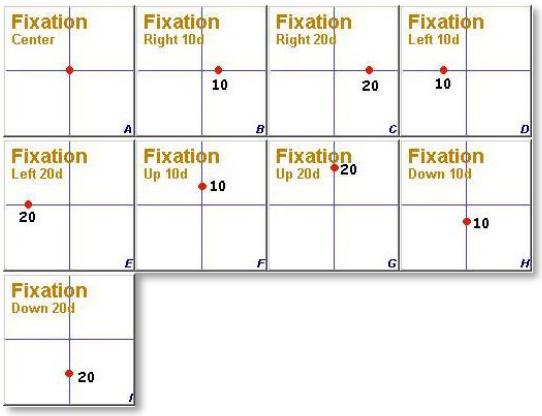
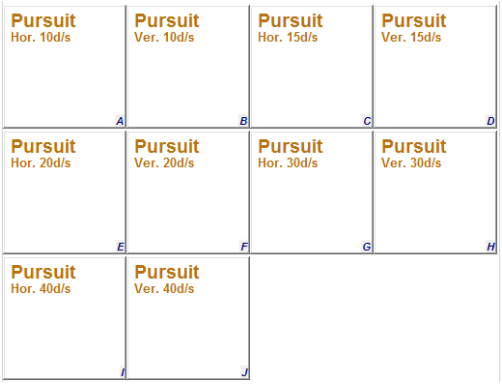
FIXATIONS

These tests are designed for the evaluation of the stability of fixation and for the study of nystagmus for different positions of fixation.



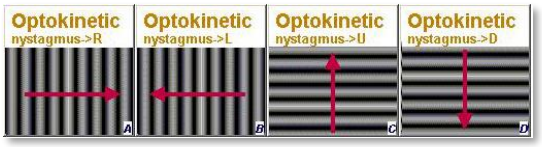
PURSUITS

These tests are designed for the evaluation of visual pursuits. They are available for horizontal and vertical movements as well as for different stimulus velocities from 10 up to 40 degrees per second.



OPTOKINETIC NYSTAGMUS

These tests are designed for the study of the optokinetic nystagmus with horizontal movements to the right (“R”) or to the left (“L”) as well as vertical movements upwards (“U”) or downwards (“D”).



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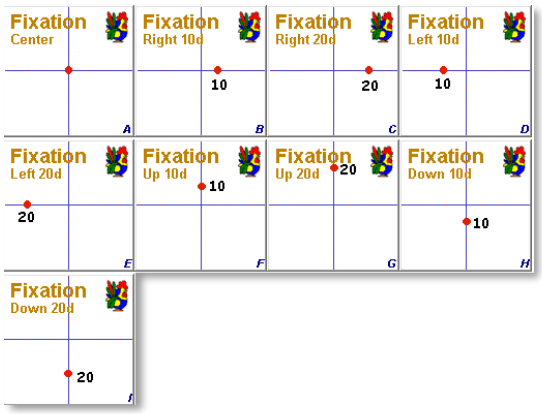
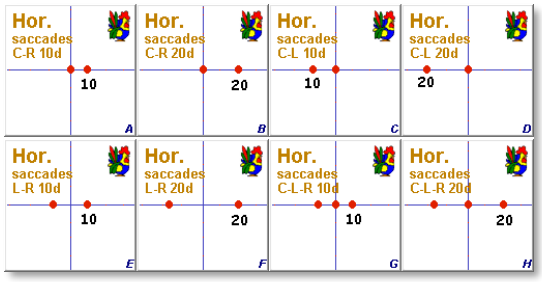
FIXATIONS FOR CHILDREN

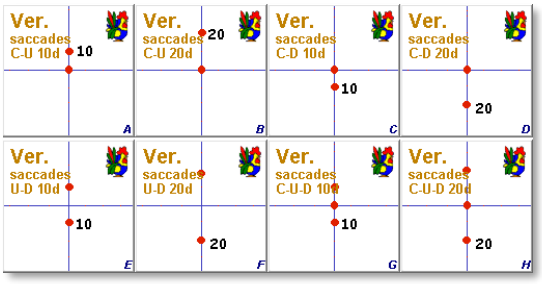
The following tests are using little figures to maintain the attention of children. Otherwise, they are similar to the tests sued for adults



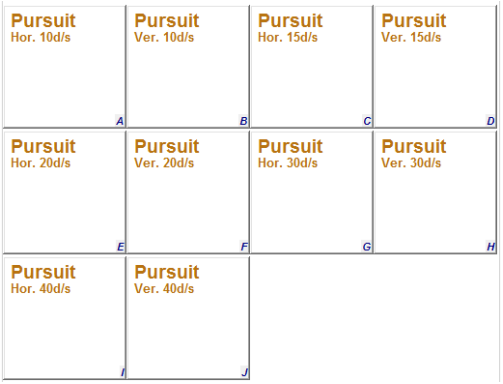
HORIZONTAL SACCADES FOR CHILDREN



VERTICAL SACCADES FOR CHILDREN



PURSUITS FOR CHILDREN



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REALIZATION OF AN EXAM

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INSTALLATION OF PATIENT

First of all, before starting the exam, you must:

1. Identify the patient and the stimulated eye.
2. Select the examination protocol.

The program will then PAUSE to allow the installation of the patient.

3. Adjust the height of the seat and of the examination table to make the patient as comfortable as possible
   It is recommended to have the patient seated in an elevated position so that the head will be in contact with the head rest for the whole duration of the recording).
4. In case of monocular exam, place an occluder over the non-tested eye.
5. Adjust the height of the chin rest so that the eyes and the reflective dot are in the rectangle displayed in the video window.
6. Place the optical correction necessary for the distance from the screen.

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ADJUSTING THE IMAGE OF THE EYE

Place the reflective dot.
The ideal position is just above the bridge of the nose, slightly above the horizontal level of the two eyes.

When the reflective dot is detected, the program displays its contour and searches for the pupils in a rectangular area loacted about 10 mm below the reflective dot. If the pupils are detected, their contour is also automatically displayed.

In case of absence of detection of the reflective dot:

- Check if the reflective dot is detected : it must be placed a few millimeters below the upper border of the vizualisation window.

In case of absence of detection of the pupils:

- Check if the pupils are not too far away from the reflective dot (the difference in height should not be larger than 20 mm). Reposition the reflective dot if this distance is too large.
- The pupils may be undetected if the contrast between the iris and the pupil is low. In this case, the detection may be amplified by clicking once or several times on button **'+'** of the Fixation monitor window. Click on button **'-'** to return to the initial state.

- Another possible cause is that the pupil diameter is too small to allow their detection. On possible solution is to reduce the luminance of the stimulation background by clicking on the "LUM" button.

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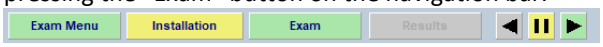
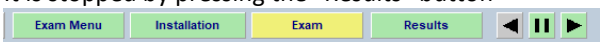
ACQUISITION OF MEASUREMENTS

The acquisition of eye movement data is started by pressing the “Exam” button on the navigation bar.



It is stopped by pressing the “Results” button



Important note

The acquisition of eye movements should be sufficiently long to allow the analysis of the movement parameters. This is particularly important when performing tests for step, gap, overlap saccades and antisaccades where a minimum of recording time of 50 seconds is recommended. The acquisition time is displayed on the top right of the exam window.

VIDEO RECORDING

Video recording

The video of eye movements can be recorded during the exam: Press the button **before** starting the exam (it is no longer possible once the exam is started).

Stop recording

The recording can be stopped at any time by pressing “S”.

Important note

Recording the video may reduce the sampling frequency of the eye movements and consequently may affect the measurements of latencies and velocities.

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EXPLOITATION OF RESULTS

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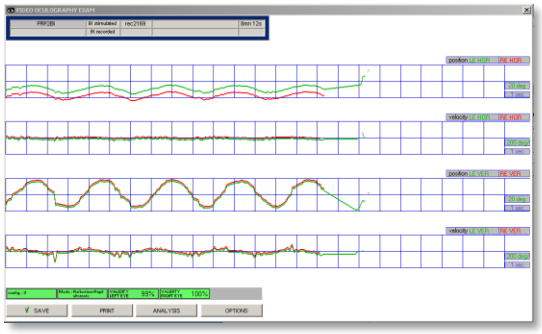
ACCESS TO RESULTS

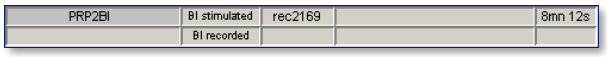
Results are accessible directly, at the end of each acquisition or by recalling them when they are stored on disk.

VISUALIZATION OF RESULTS

The main window



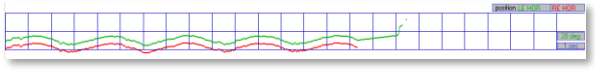
The stimulation conditions are displayed on top:



- BI stimulated when both eyes are stimulated simultaneously.
- RE stimulated (left eye occluded).
- LE stimulated (right eye occluded).

The window displays the following curves (from top to bottom):

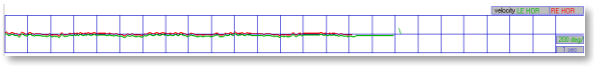
- A curve giving the horizontal position versus time.



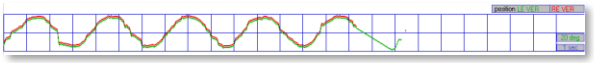
When the eye looks right, the line is above the axis and reciprocally when the eye looks left, the line is below:

- in red color: for the right eye ("position RE HOR")
- in green color: for the left eye ("position LE HOR")

- A curve giving the horizontal velocity versus time (velocity LE HOR RE HOR).



- A curve giving the vertical position versus time.



When the eye looks up, the line is above the axis and reciprocally when the eye looks down, the line is below:

- in red color: for the right eye ("position RE VER")
- in green color: for the left eye ("position LE VER")

- A curve giving the vertical velocity versus time ("velocity LE VER RE VER")

Calibration

The purpose of calibration is to provide an estimate of amplitudes and velocities in degrees from measuring data that are obtained in mm.

A RELIABLE CALIBRATION CAN ONLY BE MADE IF THE SUBJECT FIXATES THE DIFFERENT TARGETS USED IN THE CALIBRATION PROCEDURE

The calibration protocol consists in selecting a number of reference points on the recorded data, each point corresponding to a "good" fixation of the stimulation.

Click on "calibration" to open the calibration window.

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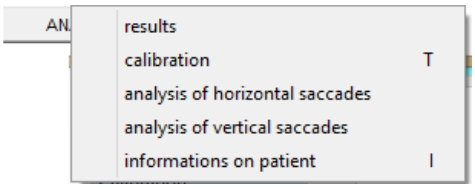
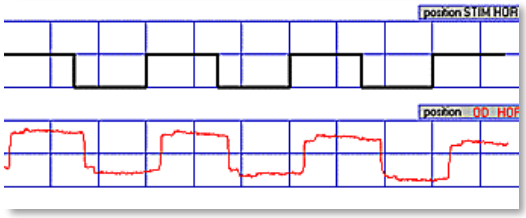
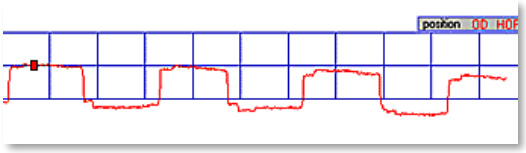


The calibration window includes the trace of the stimulus position and the traces of eye position measured from the patient.

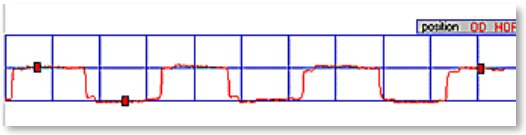


- To select a first reference point, just click on the eye position curve that corresponds to a "good" fixation.
  The curve will automatically be shifted to make the eye position coincident with the stimulus position.



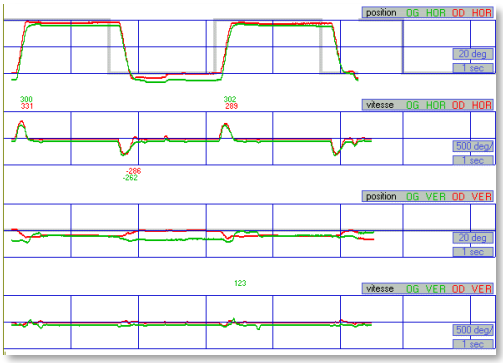
- Select a second point, corresponding to a different position of the stimulus. The curve amplitude will be modified automatically to make this last point coincident with the stimulation curve.

  Perform the same operations for the different eye position traces and click on the "VALIDATION" button to end the calibration mode.



The calibration window disappears and the results of the main window are automatically converted in degrees for the position curves and in degrees per second for the velocity curves.

The program automatically displays the velocity peaks superior to 100 degrees per second.



Easy ways: It is not necessary to perform a calibration for each recording.
You can save the calibration from one result and apply it to other results (see paragraph "options").

Note:
Once in the calibration function, the responses amplitude can also be adjusted with the keyboard arrows "right" and "left". This can be used for the calibration of visual pursuit.

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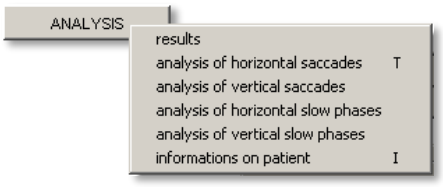
ANALYSIS OF RESULTS

Click on button ANALYSIS to perform the analysis of results.



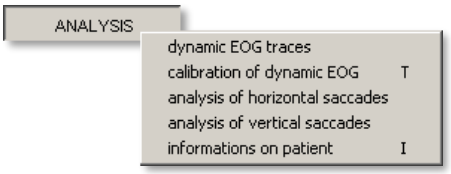
Analysis of horizontal saccades

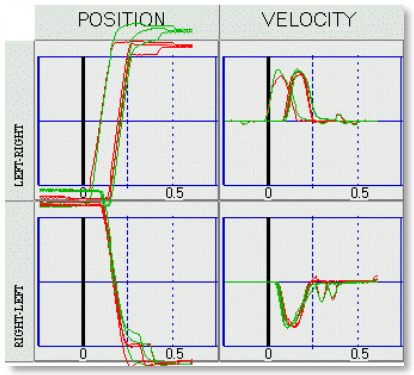
Use the command "analysis of horizontal saccades" to obtain an automated quantitative analysis of the saccade's parameters.

The different phases of the trace are analyzed separately. In the example hereby, two tables are obtained, the first one for "left to right" movements and the second for "right to left" movements.

Each table includes all the position and velocity traces of the different saccades, with the same color codes than the traces of the main window.

Note: This analysis can only be performed on results which have been previously calibrated (see paragraph "Calibration").





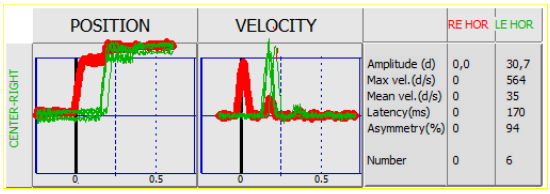
This analysis determines the following average parameters:

- **Amplitude of first movement**.
- **Maximum velocity**.
- **Average velocity**
  Over the duration of the saccade.
- **Latency**
  Time between the stimulus and the beginning of the saccade.
- **Asymmetry**
  Ratio between the duration of the acceleration phase and the duration of deceleration.

	OD HOR	OG HOR
Max vel.(d/s)	368	400
Mean vel.(d/s)	46	54
Latency(msec)	177	183
Asymmetry(%)	127	59
Number	3	3
Max vel.(d/s)	-349	-351
Mean vel.(d/s)	-48	-54
Latency(msec)	177	180
Asymmetry(%)	113	40
Number	3	3

This analysis is performed on the whole record duration. It is possible to invalidate some of the saccade responses by using the arrows of the keyboard as follows:

- the right and left arrows of the keyboard allow the selection of one saccade by moving forward or backward among the list of saccades.
- the up and down arrows of the keyboard allow to validate or invalidate the saccade which is selected. The valid saccades are displayed with a thick green trace and the invalid saccades with a thick red trace.



The entire list of saccades can be invalidated or validated by pressing the keyboard key "W". The analysis results can be copied to the clipboard by pressing the keyboard key 'Y'.

Analysis of vertical saccades

The same procedure as previously can be realized for vertical saccades.

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Analysis of pursuits gain

After the recording of pursuit tests, the program automatically displays the gain of pursuits.

By definition, **the gain is the ratio between the eye movement velocity during the pursuit slow phases and the stimulus velocity**.

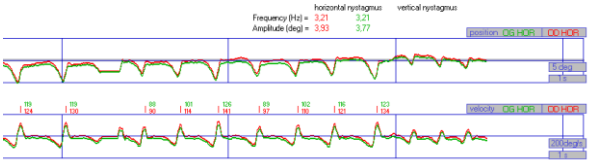
The gain is calculated on the recording sequence displayed on the screen and is denominated in percentage.

Note: calibration is not necessary for this analysis.

	RE HOR	LE HOR
Pursuit gain	72%	71%

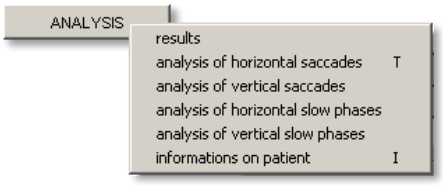
Analysis of nystagmus

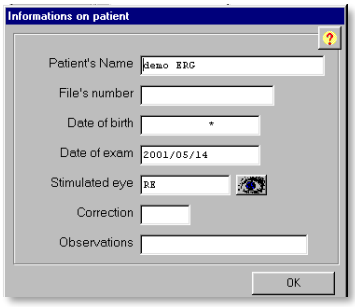
The analysis of nystagmus detects automatically the fast phases of the nystagmus and calculates the frequency (in Hertz) and the amplitude (in degrees) of the fast phases.



PATIENT'S IDENTIFICATION

This command gives access to the patient's information. It can be useful for adding comments before recording or printing the result.





SAVING RESULTS

Click on button

to store the results on the hard disk.

The reference number of the record appears on top of the screen.

The crossed sign on the button indicates that the result has been stored.

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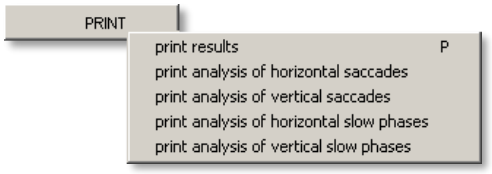
PRINTING RESULTS

The print command makes it possible to print the results and different types of analysis.



Easy ways: You can also print the results directly from the results' menu.

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TECHNICAL SPECIFICATIONS

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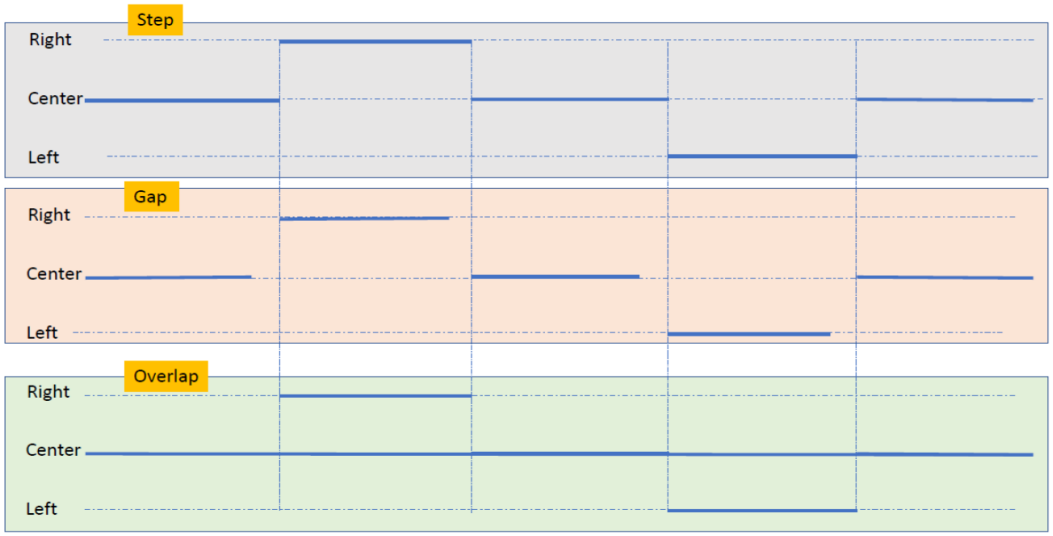
EYE MOVEMENT RECORDING TECHNIQUE

- Differential technique which reduces the influence of head movements thanks to the measurement of the head position with a reflective dot.
- Simultaneous recording of both eyes.
- Minimal constraints (no helmet and no head immobilization)
- Ability to record eye movements with large eccentricities
- Near infrared operation (940 nm) allowing eye movement recording under dark conditions.
- Sampling frequency:
  - 30 Hz with the standard camera
  - 200 Hz with the fast camera (recommended for the measurement of the velocity of saccades)

PROTOCOLS FOR STEP, GAP, OVERLAP SACCADES AND ANTISACCADES

The default protocols have the following characteristics:

- Type of movement: horizontal, 10 degrees to the right or to the left
- Duration of gap = 200 ms.



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EDITION OF PROCEDURES

WARNING

The use of the editing program requires advance training.

The use of this program without appropriate training is not recommended as it may produce alterations of examination procedures and erroneous results.

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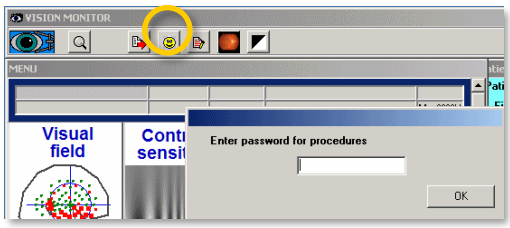
This program allows permanent modifications of the examination tests.

1- In the main menu, click on yellow icon for access to preferences.
A small window opens with the message “Enter password for procedures”.

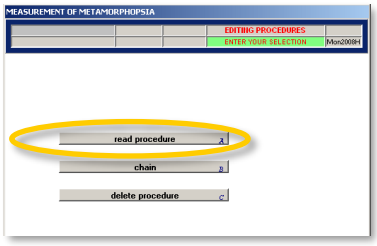


2- Enter the password and click on the button “OK”.
This will validate the access to procedures.

3- Click on the icon for Video-oculography exams.

4- Click on the button “edition of procedures”.

5- The menu for editing procedures opens.
What we will do next is read a test procedure, modify it and then save it with a new name.
Click on the button “read procedure” to read.



6- The menu of procedures is organized in pages
You first get the list of pages which are available.
Click on the button corresponding to the page of the menu you want to select.

7- Now click on the icon of the procedure that you want to work on.

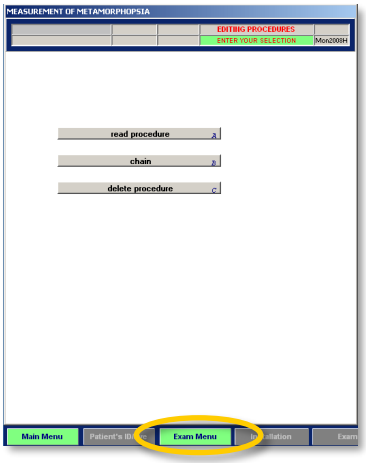
8- You get a new page with the list of parameters of that procedure.

9- If you change one parameter of the stimulation, you will see the result on the stimulation unit.
When you have made the changes which are requested, click on the button “VALIDATION” on the bottom right of the page.
You can also use the button “COPY” to make a copy of the page in the clipboard or the button “PRINT” to print the same page.

10- Now you have to select the page of the menu where you will save the new procedure.
Click on the corresponding button.

11- The program lists the tests available in that page and opens a small window to allow you to enter the name of the test.
If you want to create a new test, enter a new name (limited to 8 characters, capital letters, without ‘_’ character). After entering the name, click on the OK button.

12- After saving the new procedure, the program returns to the editing menu.
From there you can repeat the procedure to create/modify another procedure or you can go back to the examination menu by clicking on “EXAM MENU”.



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TYPICAL VALUES

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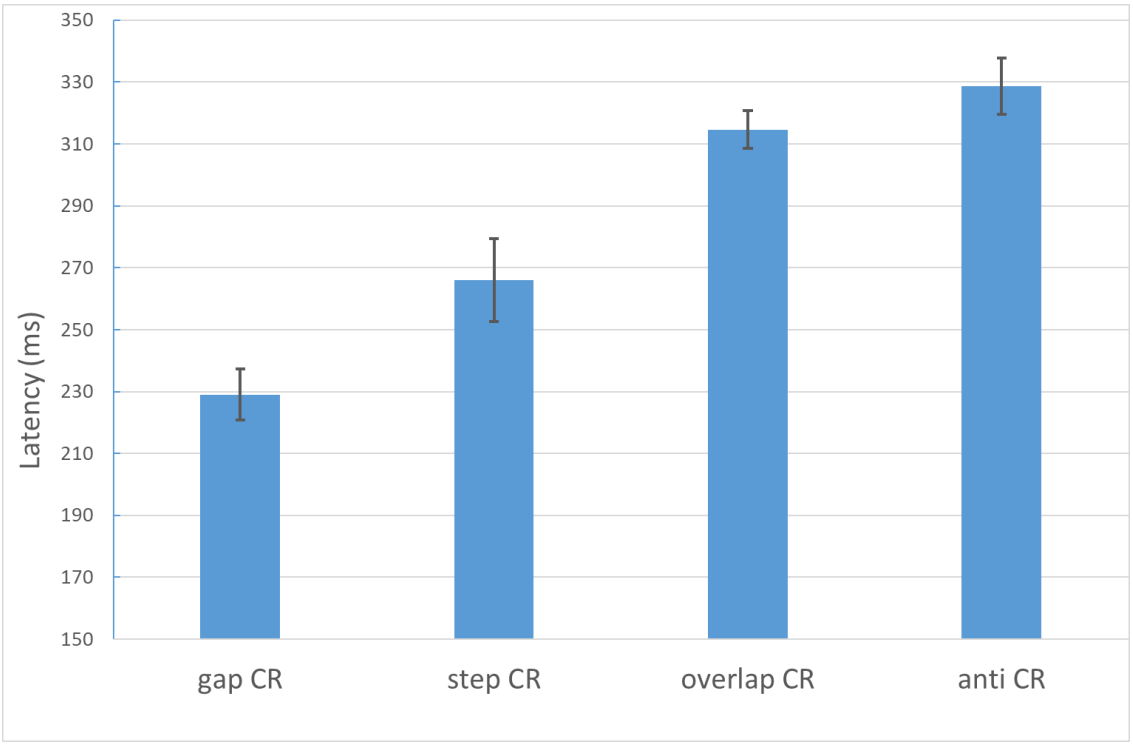
Typical values obtained with the standard protocol on 12 normal subjects for the center to right saccades.



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